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Senior High School

CURRICULUM GUIDE

AUTOMOTIVES 10 - 21 - 20 - 30
(Interim Edition, September, 1954)

Province of Alberta
Department of Education

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C O N T E N T S

General Information 5
Automotives 10 7
Shop Drafting Applied to Automotives 10 . .19
Requirements for Automotives 21 21
Automotives 20 22
Shop Drafting for Automotives 20 33
Automotives 30 34
Shop Drafting for Automotives 30 39
Bibliography 41

COURSE CREDIT VALUES

AUTOMOTIVES 10 - 4 or 5 credits

AUTOMOTIVES 20 - 8 or 10 credits

AUTOMOTIVES 30 - 10 or 15 credits

AUTOMOTIVES 21 - 4 or 5 credits

FOREWORD

No single item of family or business property can compete with the automobile for the place it holds in our daily lives. Not only is it the accepted mode of transportation for business and pleasure, but it provides the means of livelihood for millions of people.

In this highly technical age, students who are mechanically inclined will find that a sound, general knowledge of the construction, operation and servicing of the automobile can provide valuable and interesting educational training and experiences. Afterwards, he may use such knowledge in many ways, from simply driving his own car better and more safely to becoming a fully trained repairman.

Other subjects such as mathematics, science, chemistry and languages may be excellently motivated by correlating them with Automotives.

These courses give excellent scope for learning the use of many hand tools, the fundamental processes in bench work, and the need and mode of operation of many special pieces of equipment.

Although the high school courses in Automotives are not primarily trade training courses, it should be borne in mind that, since the automobile occupies such a leading position in our overall economy, many students who enroll in these courses will, either by choice or chance, find employment in direct automotive service, or associated fields.

Consequently, the instructor should be aware of the need for the integration of vocational and occupational guidance into each year of the Automotives courses. Some of the devices available to these ends are: an introduction to the school automotive shop, its equipment and tools, emphasizing comparisons with actual trade requirements and conditions; visits (later) to service garages, dealerships and other related business and industrial organizations of the community from time to time; moving pictures and literature available from automobile manufacturers, and other media.

General information and details of apprenticeship requirements under the Tradesmens' Qualification Act should be imparted to all students in Automotives courses, so that they will be familiar with the opportunities available for recognized training in case they wish to qualify. Literature available on the apprenticeship scheme should be obtained from the Provincial Apprenticeship Board at Edmonton. Field representatives of this Board are ready and willing to visit the schools in this connection.

The automotive repair trade should not be glamorized to the students, but rather they should be given the correct picture of its advantages, disadvantages, requirements as to ability and aptitudes and other related facts.

GENERAL INFORMATION

1. COURSE ORGANIZATION:

It is recommended that in the Automotives 10, 20 and 21 courses the available time be apportioned approximately as follows:

Shop Practice - - - - -50 to 60%
Theory- - - - - - - - -20 to 25%
Drafting - - - - - - -20 to 25%

2. SAFETY PROGRAM:

Every shop must have an effective safety program. In the automotive shop particular attention must be given to incorporating the safety measures as used in industry: running motors must be exhausted; machines used with adequate guards; cleanliness of shop and personnel maintained at a high standard; students properly clothed for their work; etc. Shop organization must be well developed to ensure a stress on this important phase of the shop program.

A good safety program features the following devices: regular, consistent and thorough instruction; constant vigilance and checking by instructor; safety posters; student safety committee; adequate first-aid equipment; instructor trained and up-to-date in first-aid methods; dynamic color painting of machines and equipment; adequate working space about machines; safety lines on floor around machines; routine report on accidents however minor; machines and tools in approved working condition; a safety conscious group of students and instructor, etc.

3. INSTRUCTOR'S RECORDS:

The instructor should keep accurate records of:

student enrolment and attendance
student accounts
student project activity
theory covered
tests given
student achievement

4. STUDENT RECORDS:

Instructors should ensure that the student develops and maintains a neat and accurate record of:

notes on theory
daily shop activities
project plans and records

5. GUIDANCE AND VOCATIONAL INFORMATION:

Instructors must assume responsibility in their trade area and ensure that students and school guidance officials are aware of the local situation. Instructors through the Principal have some responsibility for student placement. It is advisable that instructors be active, interested and informed.

6. ACHIEVEMENT:

The stress in our schools is QUALITY rather than QUANTITY. Instructors are responsible for ensuring that students are achieving to their capacity.

7. USE OF PROGRAM OUTLINES:

Instructors are expected to use the course outlines insofar as the shop accommodation and equipment permits. Experienced instructors may vary from this practice to a limited extent provided they can justify such variation to responsible officials.

AUTOMOTIVES 10

AN ORIENTATION COURSE

OBJECTIVES:

1. To understand the basic principles of automobile construction and operation.

2. To develop an appreciation of the complicated mechanism of the modern automobile.

3. To understand the application of fundamental mechanical principles.

4. To use the opportunity to learn about the occupational possibilities in the general field of internal combustion engines and other related work opportunities provided by the automobile.

5. To study the principles of safe and intelligent driving and to gain necessary knowledge of the modern automobile maintenance and use to serve the needs of the consumer.

6. To gain experience in the use of tools and equipment, as well as fundamental processes in benchwork.

7. To instill good work habits, a sense of responsibility and the development of safety consciousness.

THE COURSE IN UNITS:

1. The Automobile Chassis.
2. Car Care and Minor Servicing.
3. The Four-Stroke Cycle Engine.
4. The Clutch and the Gear Box.
5. The Front Axle.
6. The Steering Gear Assembly.
7. The Rear Axle.
8. Hand Bench Work.
9. Hand Soldering.
10. Additional Exercises in Bench Work.

COURSE CREDIT VALUES:

Automotives 10 - 5 credits
Units 1, 2, 3 and 4; one of 5, 6 and 7; either 8 or 9. Consider 10 optional and of an enrichment nature. (Although "one of 5, 6 and 7" is the MINIMUM requirement some reference in theory might well be made to the other units if circumstances permit. The shop work should be based on units 5 and/or 6.)

Automotives 10 - 4 credits
Units 1, 2, 3 and 4; either 8 or 9.

UNIT ONE: THE AUTOMOBILE CHASSIS

Specific Objective

To familiarize the student with the names, locations, functions and characteristics of the modern automobile by actual examination and study of an automobile, or its chassis, in the shop.

Operations, Skills and Applications

1. General examination of the chassis assembly of a modern automobile, or a complete, modern shop chassis.

2. Relationship of various units and parts - their names and functions.

3. Operational sequence of starting, running, and stopping the engine.

4. Observation of fan, generator, distributor, water pump, etc. under running conditions.

5. Characteristics of the running gear - definitions, measurements, and adjustments: Important - See Special Caution of Unit Five - "The Front Axle".

   a. Wheelbase
   b. Tread
   c. Turning radius
   d. Front Wheel Alignment - Camber, Toe-in and Toe-out, Caster and King Pin Inclination.

Related Theory

Text: Easton and Mahn: AUTOMOBILE CONSTRUCTION AND OPERATION (revised edition). Toronto. Ryerson Press.

Equipment, Tools, Materials

Car or chassis; floor jack, supports or hoist; alignment equipment, as available; hand tools, etc.

Specific Objective

To teach the student the requirements, purpose and correct procedure of general operational servicing and car upkeep.

Operations, Skills and Applications

1. Washing and polishing of car; cleaning of glass and upholstery.

2. Lubrication service - chassis, springs, gear box and differential, engine crankcase, air cleaner, oil filter, etc.

3. Periodic general servicing - correct tire inflation, tire rotation, repair of "flats" with hot and cold patches, battery service (in car), engine cleaning, fan belt inspection and change, fuel sediment bowl, hose connections, etc.

Related Theory

Text: Chapter III - Lubrication.

Equipment, Tools, Materials

Cars, sponges, chamois, water supply, cleaner and polish, vacuum cleaner with attachments or "Spick-span" etc., Engine oil, gear oils, greases, grease guns, oil cans, etc. Air compressor or hand pump, tire pressure gauge, tube repair kit or vulcanizer, hot and cold patches, cement, tire talc, tire irons, jacks, rim wrench, etc. Battery hydrometer, distilled water and kit, battery wrenches, pliers, terminal puller, baking soda, etc.

UNIT THREE: THE FOUR-STROKE CYCLE ENGINE

Specific Objective

To be able to recognize all important engine parts by their correct names; to know the fundamentals of operation of the four-stroke cycle engine and to become acquainted with the function of each unit or part in the operation.

Operations, Skills, and Applications

Note: The initial work of the first year is done preferably on practice engines, or block assemblies out of the chassis.

1. Correct procedure in the dismantling of an engine.
2. Nomenclature and study of parts.
3. Marking of numbering of rod and piston assemblies, main bearing caps and timing gears; use of valve "stick", etc., before removal.
4. Adjustment of main and rod bearings.
5. Correct re-assembly - replacement of rings, pistons and rods; valve timing; cutting of gaskets, etc.
6. Adjustment of valve clearance.

Related Theory

Text: Chapter II, The Engine.

Equipment, Tools, Materials

Engine assemblies (in or out of chassis); stands or benches; socket and box wrenches; pliers and other general tools; number stamps or punches; turning bar; piston ring compressor; oil can; shim stock; cotter pins; feeler gauges and strips; "Plastigage", gasket material, etc.

Specific Objectives

To understand the function, construction and operation of the single plate clutch; and elementary introduction to the hydraulic torque converter (fluid flywheel).

To understand the function of the selective gear box as required by the automobile; its construction and assembly; its control positions. Service requirements.

Operations, Skills, and Applications

1. Examination of single plate clutch construction and operation. Pedal adjustment to compensate for wear of clutch facings.

2. Correct procedure in the dismantling of the gears, shafts, etc., from the gear box, (if forming a unit of a chassis, or car, this will be preceded by correct procedure for removal of gear box unit).

3. Nomenclature; study of parts and their function in the general operation.

4. Computations of various gear ratios; use of idler gears to obtain "reverse" direction and slow car speed.

5. Correct re-assembly and test shifting.

6. Information on correct lubrication.

Related Theory

Text: Chapter VII, The Clutch. Chapter VIII, The Gear Box.

Equipment, Tools, Materials

Flywheel, clutch plate and pressure plate assembly and/or clutch plates of different makes. One or more gear box assemblies complete; suitable stand, or bench with vise; socket and box wrenches and other general tools, hammer and brass drift; gasket material; correct grade of gear oil, etc.

UNIT FIVE: THE FRONT AXLE

Specific Objective

To examine the general features and operation of conventional I - beam type of front axle; also modern coil spring, or independently sprung front wheels, with emphasis on the requirements of modern, front wheel steering geometry. Brakes as pertaining to front and rear wheels.

Special Caution

In the work of the first year, adjustment of front wheel alignment should be confined to practice units in a chassis. It is impractical to do such work on units removed from chassis.

The steering geometry, or wheel alignment of the modern automobile is exceedingly critical. Under no circumstances should adjustment be attempted on operating cars unless proper facilities and equipment are available and their use is fully understood.

Operations, Skills, and Applications

1. Nomenclature: study of parts and operational features.

2. General servicing and adjustment of front wheel bearings, including lubrication requirements.

3. Front wheel geometry and alignment - definition, purpose and adjustment of toe-in. Definitions and consideration of other characteristics of steering geometry - camber, caster, king-pin inclination and toe-out. (Measurement and adjustment of front end must be restricted to extent determined by special alignment equipment and tools available.

   Note: Steering geometry appears both in this Unit and in Unit One. The instructor may choose the unit in which he will treat this subject, which is to be covered only once.

4. Routine inspection and adjustment of brakes. Hydraulic fluid servicing.

Related Theory

Text: Chapter X, Front Wheel Suspension (pages 189 to 195; 204 to 210).

Equipment, Tools, Materials

Front axle assemblies - preferably at least one conventional type and one coil spring type (in or out of chassis or car); stands or supports, floor jack or hoist, wrenches, pliers and other general tools, special wheel alignment and steering geometry equipment to the extent of adjustments to be undertaken, cotter pins, wheel lubricant, hydraulic brake fluid, bleeder hose and glass jar.

UNIT SIX: THE STEERING GEAR ASSEMBLY

Specific Objective

To understand the purpose and operation of the automobile steering gear, together with a knowledge of the various types in use and the names of the principal parts involved therein.

Operations, Skills and Applications

1. Correct procedure in the dismantling of the steering gear assembly provided. (If forming a unit of a chassis or car this will be preceded by correct procedure for removal of a steering gear unit).

2. Nomenclature and study of parts and their function; identification of particular type and knowledge of other types.

3. Re-assembly and adjustments in proper sequence.

4. Computation of gear reduction (where feasible).

5. Information on oorrect lubrication.

Related Theory

Text: Chapter X, Steering Gear (pages 195 to 204)

Equipment, Tools, Materials

One or more modern types of steering gear assemblies (in or out of chassis); socket and box wrenches and other general tools; special equipment - pitman arm puller, drag link socket, steering wheel tension gauge, steering wheel puller (if necessary); gasket material and oil seals; steering gear lubricant; etc.

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Specific Objective

To investigate the mechanism employed to pass the power to the rear wheels of the automobile; to study the purpose, construction and operation of the differential assembly, including its gear reduction features.

Operations, Skills and Applications

1. Correct procedure in the dismantling of a rear axle assembly. (If forming a unit of a chassis or car, this will be preceded by correct procedure for the removal of the unit from the chassis).

2. Nomenclature, and study of parts and their operation.

3. Examination and special study of the construction and operation of the differential unit.

4. Computation of gear ratios - rear axle and overall.

5. Re-assembly of rear axle unit.

6. Adjustment of ring gear and pinion mesh.

7. Making new gasket for inspection plate.

8. Information on correct lubrication - helical and hypoid types, winter and summer requirements.

Related Theory

Text: Chapter IX, Drives and Rear Axles.

Equipment, Tools, Materials

One or more rear axle assemblies - preferably some different types, rear axle stands; socket and box wrenches, and other general tools; wheel pullers, differential carrier adjusting tool, gasket punch; wheel cylinder clamps; gear oil - regular or "Extreme Pressure" as required, etc.

UNIT EIGHT: HAND BENCH WORK

Note: It is recommended that this unit be made a required one for all students in Automotives 10, unless similar instruction and project work is covered by the individual in taking Metalwork 10.

Specific Objective

To impart knowledge and skill on threads and thread-cutting, relative to their application to shafts, parts, bolts, studs and nuts of the automobile.

Operations, Skills and Applications

Foreword: A program of hand bench work is given to students in this course for the general purpose of giving activity and experience with metal in measuring, layout, hacksawing, filing, marking, drilling, thread-cutting with taps and dies, finishing, polishing, etc.

1. Make a stud, 3/8" or 1/2" stock, with one end threaded with N.F. and the other end, N.C. thread to proper length.

2. Produce a hand-made, square nut, sized to the correct proportions for the diameter of stud, and finished to accepted design of a square nut. Thread to fit N.F. thread of stud.

Related Theory

Text: Chapter II, pages 56 to 58. In addition:

1. Types of threads in general use.
2. Uses of each type.
3. Proportions of standard square nuts.
4. Types of taps and dies.

Equipment, Tools, Materials

Machinist's vise, vee-clamps or jaw guards; set of standard taps and dies; hand hacksaw, try-square, steel scale, scriber, files, hammer and center punch; drill press, tap drill (required size), oil can, cutting oil; black iron or cold rolled steel bar stock in required sizes, etc.

UNIT NINE: HAND SOLDERING

Specific Objective

To give the student an elementary knowledge of soldering procedure, sufficient for applications to the automobile, using sheet metal and copper tubing.

Operations, Skills and Applications

1. Layout, form and assemble a tray or pan, such as might be useful for holding bolts, nuts, washers, etc.

2. Make a strong, leakproof splice in short lengths of copper tubing (1/4" or 5/16" O.D.) such as a butt splice using a tin sleeve; sweated joint using a cupping tool, etc.

Related Theory

1. Purpose and general requirements of soldering.
2. Composition and proportions of solders.
3. Fluxes - purpose and types. Uses for each type.

Equipment, Tools, Materials

Gas soldering stove, or blow torch, or electric soldering iron, pair soldering irons of suitable weight; file; flux; wire or bar solder; sheet metal - bright tin plate, galvanized and/or stove pipe iron (Canada Plate); copper tubing; etc.

UNIT TEN: ADDITIONAL EXERCISES IN BENCH WORK

Specific Objective

To give the students who have the necessary time at their disposal additional exercises in bench work.

Operations

The following list of suitable projects is given with their employment of fundamental bench work operations in mind:

1. Flaring tool with punch to accommodate one or more sizes of tubing.
2. Cupping tool with punch to accommodate one or more sizes of tubing.
3. Drill, grinding and sizing gauge.
4. Flat, engineer's wrench - single or double.
5. Dividers.
6. Calipers - inside, outside or combination.
7. Depth gauge.
8. Try square.
9. Riveted Joint - round headed, countersunk, flush, etc.
10. Any other suitable items.

While most shop instructors agree that shop sketching and drafting constitute an essential and integral part of the overall instruction for such units as metalwork and woodwork, some teachers of Automotives find it more difficult to assess the place of drafting in this subject. The difficulty stems usually from the fact that their emphasis is directed almost entirely to the repair and servicing of the car, rather than embracing the wider field of automobile construction, operation and maintenance. Certainly, some attention should be given to the production and manufacture of the automobile, itself.

Like all large industrial plants, automotive manufacturers require the services of many trained draftsmen who know how to place on paper, graphically and in the accepted style, the exact details of each individual part which goes into the final assembly. The results of their labors in the final form of blue, or other prints, direct the skilled craftsmen in the production of the actual parts and units. While it is true that most of our students will apply their ultimate knowledge of the automobile to local community, or personal demands, it is desirable that any course forming part of high school curricula should not overlook the broader aspects.

Drafting, as a section of the instruction in Automotives courses, should seek its material among actual automotive parts, units and bench work projects. There are plenty of simple automobile parts which can be taken into the drafting room for the purpose of teaching fundamentals of orthographic, isometric and cabinet projection. No better source for the study and application of thread and screw specifications and legends can be found.

The alert and realistic instructor will find that the courses in Automotives are just as rich in drafting possibilities as are the more traditional subjects of metalwork and woodwork.

Instructors should follow the first year outline as indicated in the Curriculum Bulletin "Special Shop Drafting Outlines". Plates with practical application to the automotive area should be developed.

AUTOMOTIVES 21

This is a 4 or 5-credit course for town and rural high school students who are taking their courses in comprehensive general shops. Such shops do not have the specialized and extensive equipment and facilities found in the unit automotive shops.

The prerequisite for this course is Automotives 10.

The instructor is to select the material from Automotives 10 which was not taught in the prerequisite course. Additional work if required may be selected from Automotives 20.

This course may only be offered on special approval of the Department of Education.

AUTOMOTIVES 20

A VOCATIONAL AUTOMOTIVE ELECTRICITY COURSE

THE COURSE IN UNITS:

Note: This organization indicates scope and is not to be considered suggestive of sequence.

1. Introduction to the Fundamentals of Electricity.
2. Ignition.
3. The Starting Motor.
4. The Generator.
5. Car Wiring and Lighting.
6. The Storage Battery.
7. Additional Exercises in Electrical Application and Installation.

COURSE CREDIT VALUE:

Automotives 20 - 8 or 10 credits.

1. In centers offering Automotives 10 for 5 credits it is recommended that Automotives 20 be offered for 10 credits.
2. For the 8 credit course a reduction of amount of work done in Unit 7 is suggested.

UNIT ONE: INTRODUCTION TO THE FUNDAMENTALS OF ELECTRICITY

Specific Objective

To familiarize the student with the fundamentals of electricity, the symbols used, types of electrical circuits, magnetism and its relation to electrical generation, and those general characteristic which will enable the student to apply these principles in automotive circuits.

Operations, Skills and Applications

Since shop practice as such on fundamentals is definitely limited, and the experience of the student at a minimum, it is felt that lecture work on this topic should be closely co-ordinated with suitable demonstrations and models always associating it closely with the automobile.

1. Characteristics of electricity: Definition, flow, force and work. Conductors and insulators. Making of a test lamp for use in the shop or home. Making of suitable electrical joints and the attaching of terminal ends, soldering of same.

2. Magnetism, laws of magnetism, relation between magnetism and electricity. Types of magnets. Factors governing the strength of magnets. Making of an electric magnet and the application of the Left Hand Rule. Testing polarity of generators and motors field.

3. Units of electrical measurement: Volt, Ampere, Ohm, Watt. Ohm's Law. Correct use of voltmeters and ammeters to test force and flow in a circuit. Compute the resistance and wattage in a circuit.

4. Types of circuits: Series, Parallel, Series parallel. Hooking up of lamps in series and parallel and testing with meters. Using dry cells to build up voltage.

5. Alternating current vs Direct current as a source of power for the car. General characteristics of each type.

6. Applications of electromagnetism. Field about a straight wire. The solenoid. Induced current. Self induction and mutual induction. Making of an air coil, checking its strength, then inserting a soft metal core and again checking it for pull.

Related Theory

Text: Crouse: AUTOMOTIVE ELECTRICAL EQUIPMENT. (revised edition). (Pages 188 - 197). McGraw Hill Company.

Additional Reference: Heitner: AUTOMOTIVE MECHANICS. (Pages 184 - 209). D. Van Nostrand Company, Ltd.

Equipment, Tools and Materials

0-15 voltmeter, 0-50 Ammeter, bar magnet, glass, iron filings, 6 volt battery, four 1½ volt dry cells, various sizes of wire, terminal assortment, six volt bulbs of various sizes and suitable sockets so that they may be made up into circuits. Small compass, and resistance wire.

UNIT TWO: IGNITION

Specific Objectives

To understand the function, construction and operation of the ignition system of the car.

To become proficient in ignition timing.

To be able to diagnose common ignition ailments and to make satisfactory repairs.

Operations, Skills and Applications

1. Nomenclature and study of the various parts which go towards the making of the common battery ignition system. Switch, ignition coil distributor, condenser, breaker points and spark plugs. Testing and servicing of all the above mentioned parts. Overhauling of a complete distributor and testing of same.

2. Ignition wiring and rough timing of an engine. A running model should be used and each pair of boys given the opportunity to do this from the very beginning.

3. Using a timing light. This should be used as the culmination of the above operation.

4. Studying, servicing and synchronizing of the dual point distributors. Special ignition circuits and designs - e.g. twin ignition, Ford V8 etc.

5. Spark advance mechanisms. Centrifugal vacuum types. Function of these features and how accomplished by various manufacturers. Servicing of these units.

6. Testing equipment. Use of available testing equipment for testing coils, condensers and distributors. Use of the synchrograph, synchronizer, and tach-dwell tester.

7. Magneto - principles and operation.

Servicing of ignition equipment on cars such as replacing of worn wires, testing units, locating points of high resistance and replacing needed parts gives excellent first hand training.

Related Theory

Text: Crouse: AUTOMOTIVE ELECTRICAL EQUIPMENT. (revised edition). (Pages 227 - 239). McGraw-Hill Company.

Additional Reference: Heitner: AUTOMOTIVE MECHANICS. (Pages 252 - 271). D. Van Nostrand Company, Ltd.

Equipment, Tools and Materials

Supply of used distributors, coils, condensers and ignition units. Running model for timing. Test equipment such as: coil tester, condenser tester, dwell tester, volt meter, synchronizer. Supply of wire, terminal ends, and assortment of hand tools. Timing light. Batteries and battery charger.

Specific Objectives

To understand the function, operation and construction of the cranking motor.

To be able to diagnose and repair common starting motor ailments.

Operations, Skills and Applications

1. Tracing of the electrical circuit throughout the starting motor.

2. Checking of all parts of the motor for electrical and mechanical ailments.

3. Replacement and lapping of brushes, servicing commutator, replacing bearings, lubrication.

4. Testing of motor for speed and torque.

5. Checking of units of engagement. Bendix, overrunning clutch, Bendix drive starter switches. Solenoids and solenoid shift with Relay and vacuum switches.

6. Checking of voltage in the starter motor circuit.

Exercise Work

Dismantling and assembling of practice starting motors and units off cars. A supply of these units should be built up with a mind to obtaining as wide a variety as possible. It is not always practical to repair units kept for this purpose as boys often obtain more from diagnosing ailments that are in a unit than from working with a unit in good repair.

Related Theory

Text: Crouse: AUTOMOTIVE ELECTRICAL EQUIPMENT. (revised edition). (Pages 203 - 214). McGraw Hill Company, Ltd.

Additional Reference: Heitner: AUTOMOTIVE MECHANICS. (Pages 218 - 231). D. Van Nostrand Company.

Equipment, Tools and Materials

Starting motors of various kinds equipped with different drives. Common hand tools; Speed indicator or tachometer; one foot torque bar with a 25 pound spring scale. Test lamp. Armature cutting lathe. High rate ammeter. Special battery cables.

Specific Objectives

To give the student a clear understanding of the role played by the generator on the car.

To understand the principle of electrical generation and how it is used.

To be able to diagnose and repair common generator troubles.

Operations, Skills and Applications

1. Dismantling of assembly. Identification of parts.

2. Tracing of external circuits: testing of field coils and armature for shorts and open circuits.

3. The armature: testing with the growler, turning and undercutting the commutator.

4. Checking and servicing of all mechanical parts: Bearings, brushes, brush holders, springs.

5. Checking all electrical connections: soldering of armature wires on the commutator, repairing of field coils.

6. Test running of unit: plotting of charging amperage and voltage on a graph.

7. The cutout: Purpose, construction, and common ailments. Making of satisfactory adjustments for armature and point gap.

8. Regulation: Two and three brush generators. Voltage regulator; step type and vibrator type. Voltage and amperage regulator, purpose, construction and adjustment. (It is felt that regulators are an important part of the charging circuit and should be practiced upon by the students in the shop on the test bench, but not on cars).

   Note: Care should be taken that instruction of the condition of battery and the relationship between it and the regulator are emphasized.

Related Theory

Text: Crouse: AUTOMOTIVE ELECTRICAL EQUIPMENT. (revised edition). (Pages 113 - 227. McGraw-Hill Company.

Additional Reference: Heitner: AUTOMOTIVE MECHANICS (Pages 231 - 251). D. Van Nostrand Company.

Equipment, Tools and Materials

0-15 voltmeter, 0-50 Ammeter, hand tools, soldering equipment, supply of electrical wire, insulating tape, growler, test lamp. Terminal ends, armature lathe equipped with undercutting attachment. Test bench or suitable variable speed motor which may be used to drive generators. Minimum of one H.P. 3/4 ohm resistant unit for voltage regulation setting. Supply of generators and regulators. Speed indicator or tachometer.

UNIT FIVE: CAR WIRING AND LIGHTING

Specific Objective

To make a practical study of the various wiring and lighting circuits of the average automobile.

To understand the functions of the instruments involved: ammeter, switches, bulbs, gauges, etc.

Special Note

It is recommended that this study be done either on "stripped" chassis, or on "live" demonstrator boards made up of actual operating units collected and mounted.

A student should be able to draw a simple schematic showing the various units and connecting wires. Demonstrator boards and chassis are not always available.

Operations, Skills and Applications

1. A general study and tracing of the electrical circuits of an automobile, including gauges and accessories.

2. Methods of replacement and adjustment of sealed beam units or light bulbs.

3. The replacement of blown fuses and the tracing of the cause.

4. The removal, cleaning, and the correct replacement of battery cables.

5. The replacement of new wires, wire terminals, and accessories.

6. Practice general electrical trouble-shooting and re-wiring.

Related Theory

Text: Crouse: AUTOMOTIVE ELECTRICAL EQUIPMENT. (Second Edition). McGraw-Hill Company.

Heinter: AUTOMOTIVE MECHANICS. (Section Four). D. Van Nostrand Company.

Kuns: AUTOMOTIVE ESSENTIALS. (Chapter II). Bruce Publishing Company.

Manufacturers' Service Manuals - Electrical Sections.

Equipment, Tools and Materials

Demonstration boards, wire (various sizes), fuses (various sizes), bulbs, terminals, solder, soldering iron, screw-drivers, battery terminal puller, headlamp, aligning equipment, test lamps, pliers and diagonal cutters.

Equipment, Tools and Materials

Battery parts, voltmeter, ammeter, cell-tester, hydrometer, battery charger, distilled water, sulphuric acid, battery pliers, terminal puller, ceramic container for mixing electrolyte, volt-meter with negative reading in tenths of a volt, sealing compound, lead burning torch, baking soda, etc.

UNIT SEVEN: ADDITIONAL EXERCISES IN ELECTRICAL APPLICATION AND INSTALLATION.

Specific Objective

To give the students who have the necessary time further practice in the application of knowledge acquired.

Suggested Operations

Installation of:

- Turning lights.
- Spot lights.
- Back-up lights
- Sealed beam adapters.
- Light relays.
- New battery cables.
- Horn relays.
- Horn wires.

Insulating cables.

Additional battery service work.

Any other suitable operation.

UNIT SIX: THE STORAGE BATTERY

Specific Objective

To enable a student to understand the functions, general care and servicing of the automotive type of storage battery.

Operations, Skills and Applications

1. Learn the functions of the storage battery.
2. Obtain a knowledge of its construction in general, with reference to the parts of the battery.
3. Learn the correct procedure for mixing the electrolyte, adding to, or changing the electrolyte.
4. Obtain a knowledge of the chemical reactions during charge and discharge.
5. Become familiar with types of chargers and types of charge.
6. Become familiar with causes of battery failure, and battery testing.
7. Practice the correct procedure for the removal and installation of the battery.

Note: The building of parts, or all of batteries is permissible were equipment and facilities are available.

Related Theory

Text: Crouse: AUTOMOTIVE ELECTRICAL EQUIPMENT. (Chapter II, III). McGraw-Hill Company.

Kuns: AUTOMOTIVE ESSENTIALS. (Chapter 12). Bruce Publishing Company.

Heitner: AUTOMOTIVE MECHANICS.D. Van Nostrand Company.

Auto-Lite Service Manual - United Motors Service.

Delco Remy Service Manual - United Morors Service.

SHOP DRAFTING FOR AUTOMOTIVES 20

See remarks on Page 19 relative to Drafting for Automotives 10.

This second year course dealing essentially with automotive electricity provides a rich source for drafting material varying from actual parts to the specific circuits of such electrical units as generators, relays and ignition systems together with overall wiring diagrams of typical car systems.

AUTOMOTIVES 30

A VOCATIONAL AUTOMOTIVE COURSE

Recognition of High School Technical Electives in Apprenticeship Training:

Arrangements with the Provincial Apprenticeship Board have been made for the recognition of Unit Shop courses in the high schools on the following terms:

(a) A student who has successfully completed Automotives 10, 20 and 30 at an approved Unit Shop under a journeyman instructor, may sit for an examination set by the Advisory Committee of the Apprenticeship Board and if successful will be granted a one year credit of apprenticeship training, thereby allowing the student to start his second year of apprenticeship on leaving high school.

(b) A student who has successfully completed Automotives 10, 20 and 30 at an approved Unit Shop, not under a journeyman instructor but one who has had considerable training and experience in the trade to the satisfaction of the Apprenticeship Board, may begin his apprenticeship training and if after three months of training on the job his work reaches a satisfactory standard he may be allowed to sit for an examination in his trade set by the Advisory Committee of the Apprenticeship Board and if successful he may then proceed to the second year of his apprenticeship training.

For further details apply to the Director, Provincial Apprenticeship Board, 4th Floor, Administration Building, Edmonton.

AUTOMOTIVES 30

The material in this course outline indicates the suggested type and scope of studies and shop work in the third year.

Automotives 30 may be offered for either 10 or 15 credits. The variation will be essentially in the amount of shop work done.

Related Theory

1. The manufacture of the automobile.

   References:
   METALLURGY AND WHEELS - General Motors Corporation.
   METALLURGY - Henry Ford Trade School. Dearborne, Michigan.

2. Elementary thermodynamics of the internal combustion gasoline engine:

   a. Use of power by the automobile:
      Rolling resistance
      Grade resistance
      Wind resistance
      Acceleration

   b. Brake horsepower (B.H.P.):
      Definition
      Computation
      Prony Brake
      Dynamometer

   c. Indicated Horsepower (I.H.P.):
      Definition
      Computation
      The Otto Cycle and Displacement Diagram

   d. Rated Horsepower (S.A.E.):
      Definition
      Computation
      Present day use

   e. Compression ratio.
      Compression pressure.

   f. Engine efficiencies: various types such as volumetric, thermal, mechanical, etc.

   g. Heat losses.

   h. Combustion Chamber design.

   i. Effects of altitude on engine performance.

j. Gasoline: properties, impurities, detonation, "Ethyl" fluid, octane rating, etc.

Reference:

Duell, C.C.: MOTOR VEHICLE MANUAL. Indianapolis. Wm. Burford Printing Company.

3. General Automotive theory:

a. Fuel and Carburetion Systems.

b. Rear Axles.

c. Brakes.

d. Torque Converters and Automatic Transmissons.

Shop Practice

The senior year in shop practice shall cover the general maintenance repair and servicing of automobiles brought into the shop from various sources.

Certain aspects of Automotives 30 shopwork can also be taught through provision of complete automobile chassis and separate units if in good shape and comparatively modern.

It is difficult to lay down a stated program of service repair or projects to be covered by each individual student, because the instructor cannot get a supply of work, which gives opportunity for all types of jobs.

However, the following list provides a guide as to the class of work desirable and possible for attention of third year classes:

1. Installing new piston rings.
2. Expanding pistons.
3. Fitting new piston pins.
4. Refacing, reseating and grinding valves and seats, adjusting valve clearance.
5. Cleaning carbon.
6. Installing new gaskets.
7. Adjusting main and rod bearings.
8. Aligning piston and rod assemblies.
9. Overhauling water pumps.
10. Overhauling oil pumps
11. Overhauling fuel pumps.
12. Overhauling and servicing carburetors.

13. Cleaning and servicing air cleaner.
14. Clutch refacing and adjustment.
15. Gear box overhaul.
16. Rear axle assembly overhaul.
17. Front axle assembly overhaul.
18. Brake relining.
19. Brake adjustment.
20. "Bleeding" hydraulic brakes.
21. Adjusting fan belt.
22. Adjusting timing chain.
23. Installing new timing chain, timing gears, etc.
24. Checking compression pressure.
25. Checking fuel pump pressure.
26. Renewing hose connections.
27. Lubrication.
28. Engine oil - checking and changing; flushing.
29. Removal and replacement of parts and units associated with many jobs such as:

Cylinder heads	Springs
Manifolds	Wheels
Oil pans	Axles, etc.

30. Rebushing front axles.
31. Adjusting steering gears.
32. Aligning front wheels - toe-in, etc.
33. Reaming, honing and rebushing.
34. Presswork and straightening.
35. Simple body and fender "bumping", etc.
36. Replacement of windshield and window glass.
37. Window operating mechanism repair.
38. Tightening body, fender bolts, etc.
39. Tire and wheel service.
40. Engine tune-up.

The degree to which this general list of jobs, and many others not enumerated, might be attempted and accomplished will be limited only to the general equipment of the shop, the experience of the instructor and the space and other facilities which are available.

SHOP DRAFTING FOR AUTOMOTIVES 30

Working drawing of more difficult automotive parts such as crank shafts, gear and tooth nomenclature and construction, cams, differential parts, pistons with sectional views, steering gear parts, carburetor and fuel pump cross-sections, etc.

B I B L I O G R A P H Y

TEXT BOOKS:

Automotives 10: Easton and Mahn: AUTOMOBILE CONSTRUCTION AND OPERATION (revised edition). Toronto. Ryerson Press.

REFERENCE BOOKS:

Crouse: AUTOMOTIVE MECHANICS. Toronto. McGraw-Hill Company.

Although this textbook is a comparative newcomer, it has become an outstanding authority on the subject. It covers the theory of the modern automobile through thirty chapters, each of which is divided into numbered and titled sections for quick location of desired information. Each chapter terminates with a number of review and study questions. There is scarcely a page without excellent photographs, diagrams or sketches of important parts and units which add immeasurably to the readability and usefulness of the book. Although primarily a theory textbook rather than a service reference, it presents the material in a most practical manner. This final chapter is devoted to some of the general tools and equipment of automotive shop practice. It has 774 pages.

Crouse: AUTOMOTIVE ELECTRICAL EQUIPMENT. Toronto. McGraw-Hill Company of Canada, Ltd.

Most automotive texts endeavor to deal with the electrical system of a car in a single chapter, or two. The teacher and student who wants more information on this extensive field of automotive electricity will find an entire volume of 330 pages devoted to it in this text. The book follows the general style of its author's, "Automotive Mechanics" and makes an excellent companion volume to it.

Glenn: Exploring Automotives.

A well illustrated recent book quite useful for Automotives 10.

Duell, C.C.: THE MOTOR VEHICLE MANUAL. Wm. B. Burford Printing Company. Indianapolis.

Heitner: AUTOMOTIVE MECHANICS. D. Van Nostrand Company.

A welcome newcomer to the textbook field for automotives. It is very well illustrated and written in a style that is most interesting as well as informative. Up to date on specifications and data, is authorative enough to be a real help in all phases of automotive work, both electrical and mechanical. Each phase of the car is dealt with independently and at the end of the chapter a trouble-shooting chart listing the symptoms and possible causes is given. A series of questions also follows each chapter. The book is well bound and the paper of excellent quality.

Kuns: AUTOMOTIVE ESSENTIALS. Bruce Publishing Company.

This book on motor mechanics is one of the early texts in this field, but has been frequently revised to keep it up-to-date. It is strictly a theoretical book as it does not deal at all with shop practice. Each chapter ends with a number of review and research questions. Paper is of excellent quality with good illustrations on nearly every page.

Kuns: AUTOMOTIVE SERVICE, Volumes I and 2. Bruce Publishing Company.

These two books are useful references both with regard to theory as well as practical shop jobs on actual automotive units. The chapters, or sections as they are called, alternate as theory chapters followed by practical applications of the material in the form of "jobs". High grade, glossy paper is used; illustrations and diagrams are excellent and up-to-date. For the most part, the jobs covered are of a general nature and they do not permit use of precise manufacturer's data on definite cars and models. Volume 1, 554 pages; Volume 2, 744 pages.

Delco-Remy: ELECTRICAL EQUIPMENT OPERATION AND MAINTENANCE HANDBOOK.

This is available from any United Motor Service center. Recommended and suitable for Automotives 20.

Auto-Lite: ELECTRICAL EQUIPMENT MAINTENANCE AND OPERATION MANUAL.

Same source and use as Delco-Remy above.

Motor's: AUTOMOBILE REPAIR MANUAL. R.W. Bruce, Midland, Ontario.

No school shop undertaking outside repair work on automobiles should be without this very practical repair manual put out in a well-bound volume. This book is primarily a shop reference source, providing the latest specifications in full for the general repair and servicing of all cars and models of recent years. In addition, it gives in excellent detail, the requisite instructions for carrying out many adjustments of the major units of the car. Illustrations and diagrams are excellent and help to clarify the reading when the reader seeks guidance. Each year the manual is revised so as to cover the cars of succeeding years. Highly recommended for Automotives 30. This publication can be procured only from the Canadian representative for "MOTOR" - R.W. Edwards, Midland, Ontario.

Crouse Workbook Series: New York. McGraw-Hill Company.

Automotive Tools
Automotive Chassis
Automotive Engines
Automotive Electricity
Automotive Service and Trouble-Shooting.

This is a series of five very informative workbooks containing a study guide, work progress report and series of exercises on each subject. They are very well illustrated and very thorough. Their value is somewhat limited by their small field and by the fact that the answers to the questions in the exercises are too easily found.

General Motors Manuals: General Motors Products of Canada - Service Promotion Department, Oshawa, Ontario.

A.B.C. of Hand Tools
Power goes to work
We Drivers
Automotive Jobs in Your Town
How Your Car is Made
Transportation Progress
Diesel - The Modern Power
Metallurgy and Wheels
Research Looks to New Horizons
Precision - A Measure of Progress
Can I be an Engineer
The Challenge of Engineering's Second 100 years
When the Wheels Revolve
Electricity and Wheels
Optics and Wheels
Short Stories of Science and Invention
American Battle of Abundance
User's Guide
Chemistry and Wheels
Can I be a Craftsman

The following colored charts are available through General Motors Corporation:

Automobile Full System
Automobile Ignition System
Engine Types

Delmar Publications: Thomas Nelson & Sons, Ltd. Toronto, Ontario.

General Repair Tools:
This basic manual presents the principles and processes which underlie the use of automotive repair tools. Emphasis is placed on developing sound judgment, safe work habits and correct procedures.

Basic Repair Operations:
Covers those repair operations which occur most frequently. Includes coverage of the auto mechanic's duties and responsibilities.

Brake Work:
Presents both related information and step-by-step procedures involved in brake work. Excellent illustrations, cut-a-ways and photographs.

These Delmar publications are available from Delmar Publishers, Inc. through Thomas Nelson and Sons of Canada, Ltd., 91 Wellington Street West, Toronto 1, Ontario.

OTHERS:

The Vehicles and Highway Traffic Act - current issue by the Provincial Government.

Local Traffic By-Laws.

Metallurgy and Metallography - Board of Education, Dearborn, Michigan.

TL 146 A325 1954
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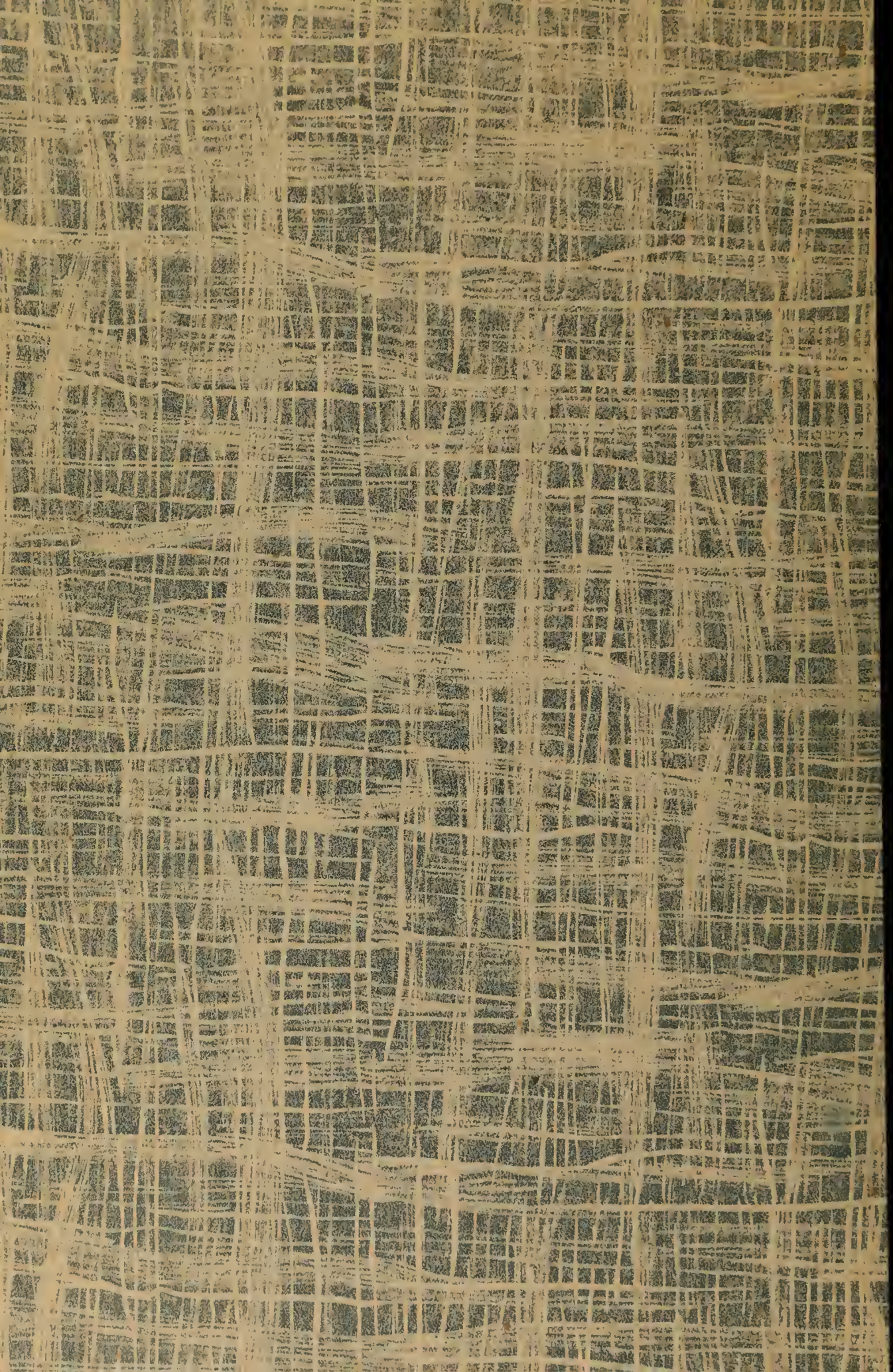
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